ONTOLOGY FOR MOBILE DEVICE UTILIZATION: TOWARDS KNOWLEDGE PERSONALIZATION IN MOBILE LEARNING

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ABSTRACT

Mobile devices usage has grown significantly in the last decade. With the advent of mobile technology, mobile devices have transformed people lifestyle including learning style. Mobile learning uses mobile technologies to carry out learning process. Typically, mobile learning involved individual learning with less or without teacher's supervision and guidance. This means that the learners need to manage their knowledge on their own. However, not all learners have similar learning ability and behaviour. The ways they manage their knowledge are different. In this study, an ontology for mobile device utilization is proposed to study the behaviour of learners in the usage of mobile device. Then, potential personalization feature, that can be included in mobile learning, can be identified based on the mobile device utilization of learners. The ways they use their mobile device is studied to identify the potential personalization feature they will use to manage their knowledge. Knowledge personalization in mobile learning is analysed based on the ontology of mobile device utilization where knowledge personalization is the ability to provide knowledge according to the learners' behaviours. Motivated by the lack of research on knowledge personalization in mobile learning especially in Malaysia, this study is conducted in Malaysia. Design science research method is used for this study and METHONTOLOGY is used for the development of ontology. The resulted ontology consists of a total of 39 concepts and 3 tiers. Questionnaire is distributed to lower secondary students in Malaysia to collect the data about the mobile device utilization. This questionnaire is mapped with concepts in the ontology developed and the finding is analysed toward knowledge personalization in mobile learning. The result from the questionnaire conducted showed that each concept is reliable and suitable for knowledge personalization in mobile learning.

ABSTRAK

Penggunaan peranti mudah alih telah berkembang dengan ketara baru-baru ini. Peranti mudah alih telah mengubah gaya hidup ramai orang termasuk gaya pembelajaran. Pembelajaran mudah alih adalah gaya pembelajaran yang baru yang menggunakan teknologi mudah alih untuk menjalankan proses pembelajaran. Biasanya, pembelajaran mudah alih dijalankan dengan kurang atau tanpa pengawasan dan bimbingan guru. Ini bermakna bahawa pelajar perlu menguruskan pengetahuan mereka dengan diri sendiri. Walau bagaimanapun, bukan semua pelajar mempunyai keupayaan pembelajaran atau kegemaran cara pembelajaran yang sama. Cara-cara mereka menguruskan pengetahuan mereka adalah berbeza. Dalam kajian ini, ontologi bagi penggunaan peranti mudah alih digunakan untuk mengkaji tingkah laku pelajar dalam penggunaan peranti mudah alih. Kemudian, ciri-ciri personalization yang berpotensi, yang boleh dimasukkan dalam pembelajaran mudah alih, boleh dikenal pasti berdasarkan penggunaan peranti mudah alih pelajar. Cara-cara mereka menggunakan peranti mudah alih dikaji untuk mengenal pasti ciri-ciri personalization yang berpotensi digunakan oleh mereka untuk menguruskan pengetahuan. Knowledge personalization dalam pembelajaran mudah alih dianalisis berdasarkan ontologi penggunaan peranti mudah alih di mana knowledge personalization adalah keupayaan untuk memberikan pengetahuan berdasarkan tingkah laku pelajar. Kaedah yang digunakan dalam kajian ini adalah kaedah penyelidikan sains reka bentuk dan METHONTOLOGY digunakan untuk pembangunan ontologi. Ontologi yang dibangunkan terdiri daripada 39 konsep yang distrukturkan dalam 3 lapisan. Soal selidik diedarkan kepada pelajar sekolah menengah rendah di Malaysia untuk mengumpul data mengenai penggunaan peranti mudah alih. Soal selidik ini dipetakan dengan konsep dalam ontologi dan hasilnya dianalisis ke arah knowledge personalization dalam pembelajaran mudah alih.

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LIST OF ABBREVIATIONS

D-Learning	-	Distance learning
KM	-	Knowledge management
KMS	-	Knowledge Management System
M-learning	-	Mobile learning
PDA	-	Personal digital assistants
PKM	-	Personal knowledge management

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Mobile devices such as personal digital assistants (PDA), tablets, smartphones, and others are emerged recently and evolved rapidly. Besides, mobile network and computing technology also emerged with the mobile devices. Then, a new form of learning emerged called mobile learning (m-learning). Different authors viewed m-learning differently. Qiang et al. (2008) defined it as a new form of learning where it uses mobile technology and devices to access to educational materials. On the other hand, Bo (2006) viewed m-learning as a further development of e-learning that realized the true potential of e-learning as “anytime”, “anywhere” and “adapted to the user”. In addition, Gourova et al. (2013) also viewed m-learning as e-learning that provided using mobile devices. Zhuang et al. (2011) however viewed m-learning as a new field of distance learning that combined with mobile technology and education. In general, m-learning is a part of e-learning and distance learning that using mobile technology and devices to carry out learning process.

In other word, m-learning is the combination of mobile technology and devices with learning. Learning is defined as the acquisition of knowledge or skills through experience, study, or by being taught (Oxford Dictionaries). From the definition, we can see that knowledge constitutes the important part in learning. Knowledge is the appropriate collection of information that is to be useful to learner. Information is data that has been given meaning by providing a context to the data while data is raw, discrete, objective facts about events. Knowledge usually is acquired through experience or education and comprises not only the ability to

choose the appropriate course of action, but also the skills to execute it as well as help in making decision.

Since knowledge plays an important role in the process of learning, knowledge management (KM) is important in m-learning. A knowledge management system (KMS) supported processes in an educational institution and facilitated learners to access various functionalities, navigate between applications, and find the knowledge they need (Gourova et al., 2013). Hence, learning effectiveness can be enhanced by transforming the ordinary m-learning to knowledge-based m-learning (Liaw et al., 2010). Since m-learning is done by learners individually because of the lack of teachers' supervision and guidance, personal knowledge management (PKM) is used instead of knowledge management. PKM is knowledge management at individual level (Xu et al., 2011) which means that the learners manage their knowledge by their own. However, every learner has their own learning ability and behaviour. Knowledge is acquired by each learner differently and hence the ways of they manage their knowledge is different. Then, the emphasis should be placed on personalization concept in knowledge management (Tochtermann, 2003).

Recently, greater attention is given to personalization no matter in business or medical context as well as in learning context. When personalization is applied in learning context, learner's motivation and depth of engagement in learning as well as the amount they learned in a fixed time period is increased (Cordova and Lepper, 1996). This is because personalization can give an experience that is tailored to individual's particular needs and personal characteristics. Every learner has their own characteristic, ability and behaviour. Providing knowledge according to their characteristics, abilities and behaviours can increase their satisfaction, learning efficiency and learning effectiveness.

1.1 Problem Background

Knowledge personalization is the ability to provide knowledge according to the learners' characteristics, abilities and behaviours. There is very limited study on knowledge personalization in m-learning. Rapid change in mobile devices features has further intensified the challenges to incorporate the features in the application (Joorabchi et al., 2013). Therefore, not all the potential mobile devices features are incorporated into the application, in particular m-learning application. Hence, a comprehensive framework is needed to conceptualize the mobile devices features that can incorporate into the m-learning application to provide knowledge personalization to learner.

In addition, different researchers have different focus on delivering the personalized content in m-learning. Zhang (2003) proposed a generic framework for delivering personalized content to mobile users based on user profile. Sá and Carriço (2009) however presented a framework which takes advantage of mobile devices' features to supports end-users in content personalisation. While, Tan et al. (2011) presented a framework for location-based m-learning system which means the focus is location. These different focuses in m-learning domain can confuse the application developer. There are different elements that can be considered in m-learning to offer knowledge personalization such as user profile, mobile devices' features, location, and others. In order to have a comprehensive understanding or conceptualization on the elements that can be included in m-learning domain, a general framework for knowledge personalization in m-learning is needed.

In this study, ontology for mobile device utilization toward knowledge personalization in m-learning is modelled. Ontology is formal knowledge representation that is about building model of the world, particular domain or problem. It was fundamental infrastructure for advanced approaches to KM automation (Sicilia et al., 2006). Ontology is used in this study because it provides a shared understanding through conceptualizing the domain knowledge existed. For example, suppose several m-learning applications provide knowledge personalization

services. If these m-learning applications share the same ontology, then authorized agents can extract and aggregate knowledge personalization information from these different m-learning applications. Then, the aggregated information can be used as input data to other applications or to answer user queries. Common understanding of the structure of knowledge personalization in m-learning is shared among people or software agents.

Besides, ontology can provide formal semantics to any sort of information. The association of information with ontologies makes the information much amenable to machine processing and interpretation (Davies et al., 2006). By modelling the knowledge personalization in m-learning using ontology, the m-learning developer can make the knowledge personalization in m-learning amenable to machine processing and interpretation.

Furthermore, there is also very limited study of knowledge personalization that looks into Malaysia context. Hence, a conceptual model of knowledge personalization in mobile learning is developed and validated based on Malaysia context.

1.2 Problem Statement

In this study, the main research question is: how to develop a conceptual model of knowledge personalization in mobile learning? There are three research questions that need to be answered before answered the main research question:

1. What is the current implementation of knowledge management in mobile learning?
2. What are the mobile devices utilisation elements that are required for supporting knowledge personalisation in mobile learning?

3. How to model the conceptualisation of mobile devices utilisation that able to support knowledge personalization in mobile learning?

1.3 Research Objectives

The main research objective is to develop conceptual model of knowledge personalization in mobile learning. To achieve this main objective, the following objectives need to be achieved:

1. To explore the current implementation of knowledge management in mobile learning.
2. To identify the mobile devices utilisation elements that are required for supporting knowledge personalisation in mobile learning
3. To model the conceptualisation of mobile devices utilisation that able to support knowledge personalization in mobile learning?

1.4 Scope

The scope of this research is in lower secondary schools. It is focused on the personalization aspect in knowledge management. The knowledge personalization is modelled based on mobile devices' features.

1.5 Expected Contribution

In this study, the current implementation of knowledge management in m-learning will be explored. Besides, knowledge personalization within m-learning will

be formally represented by ontology. The ontology can closely resemble the real world. Then, the knowledge provided in m-learning application is really tailored to each learner's needs and their learning ability and learning behaviour. The ontology also provides shared understanding through conceptualizing the domain knowledge existed. Each software agent will have a shared understanding on each concept of the knowledge personalization in m-learning. The focus area in this study is in lower secondary schools since Malaysia government is encouraging the learning using technology.

1.6 Significance of the study

This study can help in better understanding the current implementation of knowledge management in m-learning. In addition, the ontology can provide the developer of m-learning with the aspects of personalization that should be focused when develop m-learning application. It can be utilized by m-learning developer or owner as guidance so that the developed application is tailored to each learner's needs and their learning ability and learning behaviour.

1.7 Chapter Outline

The remainder of this thesis is organised as follows. The following section is Literature Review that discussed the related researches that have been done in the past. Then, the methodology that used in this study is presented in Methodology section. Next, the ontology proposed is presented in the section of Ontology. After that, the results of the questionnaire conducted in this study are shown and discussed in the section of Analysis. Finally, the study is concluded in Conclusion section with discussion on limitation of the study, future work and conclusion.

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